

CSMC 412

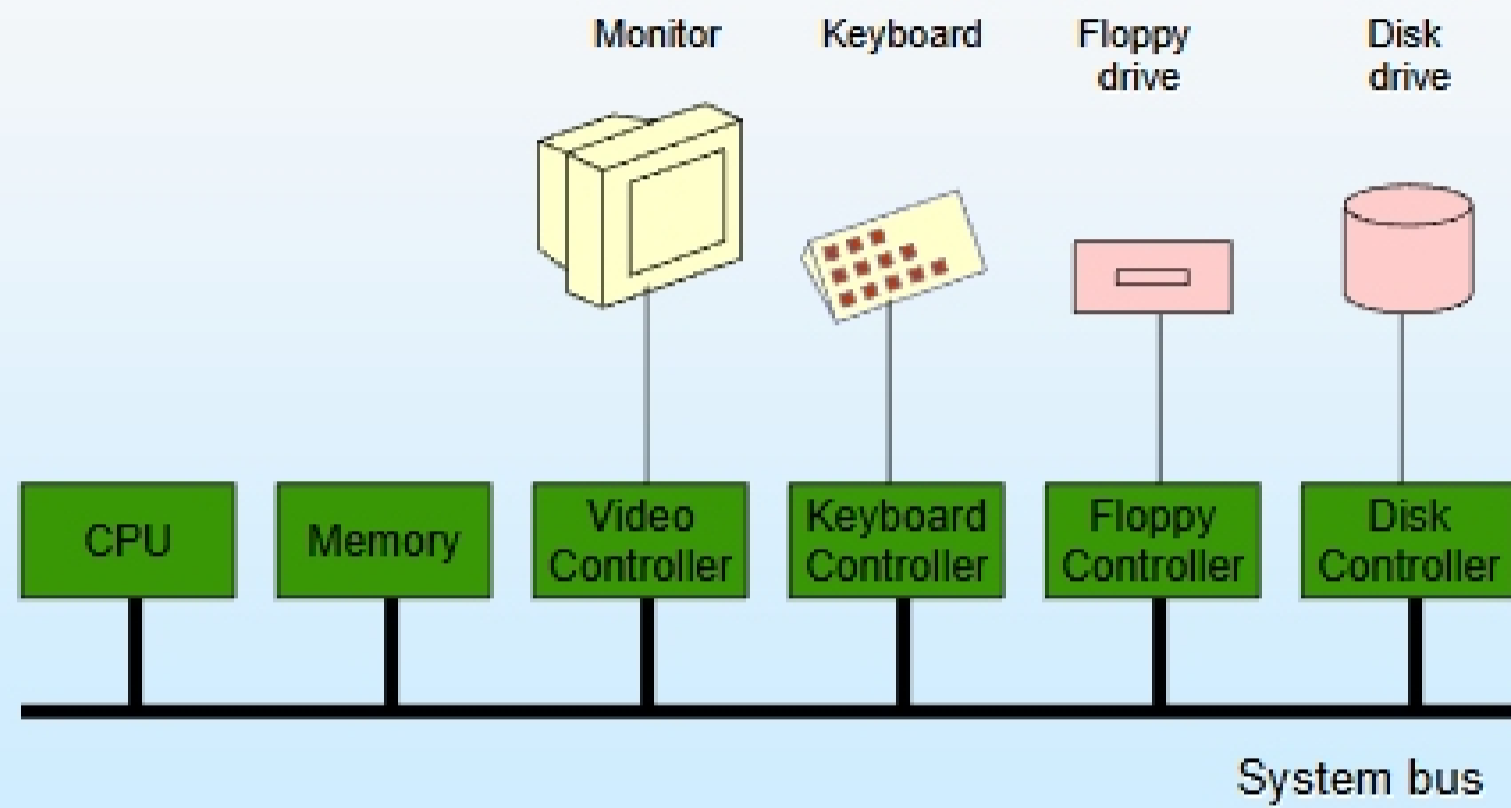
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Set 12

Input/Output – Principles of I/O Hardware

- Major components of a computer system:
CPU, memories (primary/secondary), I/O system
- I/O devices:
 - Block devices – store information in fixed-sized blocks;
typical sizes: 128-1024 bytes
 - Character devices – delivers/accepts stream of characters
- Device controllers:
 - Connects physical device to system bus (Minicomputers, PCs)
 - Mainframes use a more complex model:
Multiple buses and specialized I/O computers (I/O channels)
- Communication:
 - Memory-mapped I/O, controller registers
 - Direct Memory Access - DMA

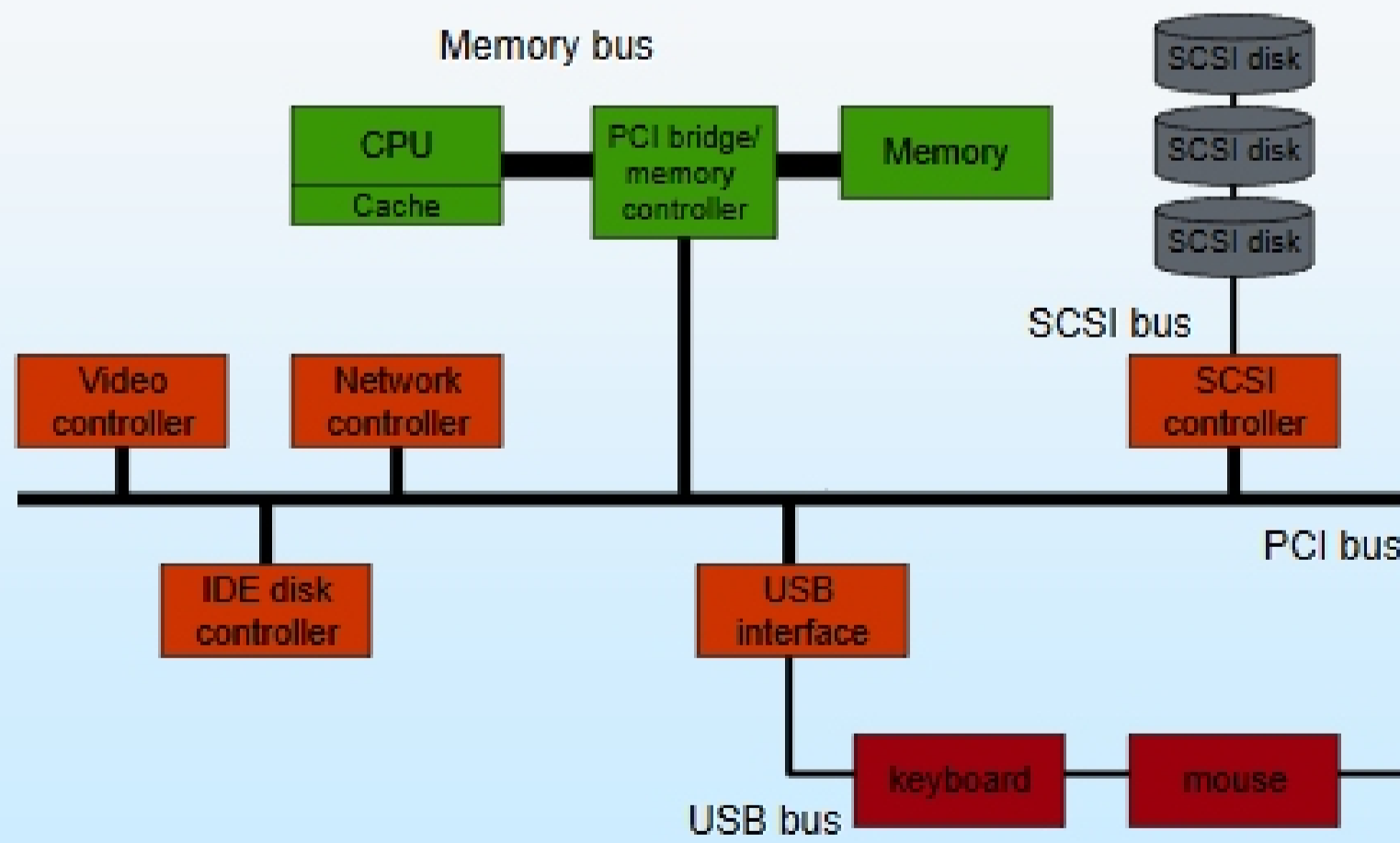
I/O Hardware - Single Bus



Operating System Concepts

12.3

I/O Hardware - Multiple Buses



Operating System Concepts

12.4

Diversity among I/O Devices

The I/O subsystem has to consider device characteristics:

- Data rate:
 - may vary by several orders of magnitude
- Complexity of control:
 - exclusive vs. shared devices
- Unit of transfer:
 - stream of bytes vs. block-I/O
- Data representations:
 - character encoding, error codes, parity conventions
- Error conditions:
 - consequences, range of responses
- Applications:
 - impact on resource scheduling, buffering schemes

Organization of the I/O Function

- Programmed I/O with polling:
 - The processor issues an I/O command on behalf of a process
 - The process busy waits for completion of the operation before proceeding
- Interrupt-driven I/O:
 - The processor issues an I/O command and continues to execute
 - The I/O module interrupts the processor when it has finished I/O
 - The initiator process may be suspended pending the interrupt
- Direct memory access (DMA):
 - A DMA module controls exchange of data between I/O module and main memory
 - The processor requests transfer of a block of data from DMA and is interrupted only after the entire block has been transferred